

**TITLE**

**METHOD AND SYSTEM FOR USING EITHER PUBLIC OR PRIVATE  
NETWORKS IN 1x EV-DO SYSTEM**

**CLAIM OF PRIORITY**

**[0001]** This application makes reference to, incorporates the same herein, and claims all benefits accruing under 35 U.S.C. §119 from my application *METHOD AND SYSTEM FOR USING TO SHARE PUBLIC AND PRIVATE NETWORK IN 1X EV-DO SYSTEM* filed with the Korean Industrial Property Office on 10 September 2002 and there duly assigned Serial No. 54625/2002.

**BACKGROUND OF THE INVENTION**

**Technical Field**

**[0002]** The present invention relates to a system and a method for using public network systems in a private network, and more particularly to a system and a method for using public network systems for mobile communication in a private network.

**Related Art**

**[0003]** Mobile communication systems have been further developed in order to provide mobility of voice calls. Due to technical developments in an attempt to meet the demands of users, mobile communication systems mainly for voice calls can now provide short data services.

1 That is, mobile communication systems provide not only voice call services, but also additional  
2 services, such as short message transmission, music file transmission for bell sounds of wireless  
3 terminals, simple Internet communications, banking services, and other services.

4 **[0004]** Studies have been performed to try to develop mobile communication systems which  
5 can provide the mobile communication subscribers with not only the services mentioned above,  
6 but also more information at higher speed.

7 **[0005]** There appears to be a need for a new, improved, convenient, and efficient method and  
8 system enabling users to access public wireless networks and private wireless networks in a 1x  
9 EV-DO system, to receive information at a high-speed rate, for video conference calls, to watch  
10 movies received from one of the wireless networks, and for other reasons. Also, there is a  
11 requirement to provide low-priced base stations and base station controllers while providing the  
12 new, improved method and system in a 1x EV-DO system.

## 13 SUMMARY OF THE INVENTION

14 **[0006]** Accordingly, the present invention has been made to solve the above-mentioned  
15 problems and to provide a system and a method for using either a public network or a private  
16 network in a high-speed wireless data system.

17 **[0007]** The present invention provides a system and a method for using either a public network

1 or a private network in a high-speed wireless data system at low cost.

2 [0008] The present invention provides a system and a method for using either a public network  
3 or a private network in a high-speed wireless data system without making any particular change  
4 in the system.

5 [0009] The present invention provides a high-speed wireless data system for providing  
6 services for either a public wireless network terminal or a private wireless network terminal, that  
7 may be constructed with a base station for assigning a temporary identifier, namely an Unicast  
8 Access Terminal Identifier (*i.e.*, an “UATI”) to each of terminals of the public wireless network  
9 and the private wireless network through a wireless channel to provide services of the high-speed  
10 wireless data system for each of the terminals; a base station controller for controlling  
11 implementation of different authentications for the terminals, assignment of an Unicast Access  
12 Terminal Identifier to each terminal, management of a session for each terminal, and data  
13 transmitted or received by each terminal; a private authentication system including an  
14 authentication database for authenticating the private wireless network terminal; a data location  
15 register including information for the public wireless network terminal and information for  
16 receiving services from the private wireless network of the private wireless network terminal;  
17 and a hub for intermediating data between the base station, the base station controller, and the  
18 private authentication system, the hub discriminating between private wireless network services  
19 and public wireless network services by means of Unicast Access Terminal Identifiers received

1 from the terminals.

2 **[0010]** The base station and the base station controller assign an Internet protocol (IP) address  
3 for performing an IP telecommunication, and processing data and signaling for the assigned  
4 address.

5 **[0011]** The system may further include a data service node connected to the hub to provide  
6 data services only to the terminal of the private wireless network.

7 **[0012]** In a case where a terminal of the private wireless network is also used in the public  
8 wireless network, the data location register stores terminal information of both the private  
9 wireless network and the public wireless network in the terminal and assigns an Unicast Access  
10 Terminal Identifier of the private wireless network to the terminal when the terminal is located  
11 within a predetermined base station.

12 **[0013]** The data location register assigns an Unicast Access Terminal Identifier of the private  
13 network to a corresponding terminal, when the terminal is located within a predetermined base  
14 station in a predetermined time zone.

15 **[0014]** The hub discriminates between private wireless network services and public wireless  
16 network services by means of Unicast Access Terminal Identifiers received from the terminals

1 in connecting a call.

2 **[0015]** In accordance with another aspect of the present invention, there is provided a call out  
3 method by a high-speed wireless data system, the system may be constructed with a hub and a  
4 base station controller, the hub discriminating between public wireless network services and  
5 private wireless network services in performing routing, the base station controller performing  
6 a control operation to provide services of a private wireless network if required from the hub.

7 When a call out is demanded from a predetermined terminal through a base station, the base  
8 station controller checks an Unicast Access Terminal Identifier and a destination address  
9 received from the terminal by the hub to determine whether private wireless network services  
10 are required or not; if private wireless network services are required, the hub connects a call to  
11 the base station and the base station controller; the base station controller checks through a  
12 private authentication system whether the terminal has been authenticated or not; and when the  
13 terminal has been authenticated, the base station controller sets the call to the requested  
14 destination address to perform communication. This method may record a location of the  
15 terminal upon completion of the communication.

16 **[0016]** In accordance with another aspect of the present invention, there is provided a call in  
17 method by a high-speed wireless data system, with the system using a hub and a base station  
18 controller, the hub discriminates between public wireless network services and private wireless  
19 network services in performing routing, the base station controller performing a control

1 operation to provide services of a private wireless network if required from the hub. With this  
2 call-in method, when a call connection is required to a predetermined terminal from a  
3 predetermined packet data service node, the base station controller demanding a paging to the  
4 location register; the location register providing an answer signal and a paging signal to a  
5 corresponding base station controller where the terminal is located; performing the paging to the  
6 terminal by the base station controller which has received the paging signal; when the paging  
7 answer signal is received from the terminal, authenticating the terminal through an  
8 authentication system; and performing communication between the terminal and the packet data  
9 service node upon completion of the authentication. This method may further comprise a step  
10 of recording a location of the terminal upon completion of the communication.

11 **[0017]** In accordance with the principles of the present invention, as embodied and broadly  
12 described, the present invention provides a high-speed wireless information distribution system  
13 providing services, with a data system providing services to at least one selected from among  
14 a public wireless network terminal and a private wireless network terminal, the services  
15 corresponding to at least one selected from among data services of a public wireless network and  
16 data services of a private wireless network. The data system may be constructed with a base  
17 station assigning a first an Unicast Access Terminal Identifier to the public wireless network  
18 terminal and a second an Unicast Access Terminal Identifier to the private wireless network  
19 terminal through wireless communication; a base station controller controlling authentication  
20 of the terminals, controlling the assignment of the first and second Unicast Access Terminal

1 Identifiers, controlling sessions of the terminals, and controlling data transmitted and received  
2 by the terminals; a private authentication system storing an authentication database for the  
3 authentication of the private wireless network terminal; a data location register storing  
4 information corresponding to the public wireless network terminal, and storing information for  
5 transmitting the data services of the private wireless network to the private wireless network  
6 terminal; and a hub intermediating data between said base station, said base station controller,  
7 and said private authentication system, said hub being in communication with said data location  
8 register, said hub distinguishing the data services of the private wireless network and the data  
9 services of the public wireless network in dependence upon the assigned first and second an  
10 Unicast Access Terminal Identifiers received from the terminals.

11 **[0018]** In accordance with the principles of the present invention, as embodied and broadly  
12 described, the present invention provides a call out method of a high-speed wireless data system.  
13 When a call out to a destination is requested from a terminal, determining whether private  
14 wireless network services are required, said determining being performed in dependence upon  
15 an address of the destination and an Unicast Access Terminal Identifier received from the  
16 terminal; when the private wireless network services are required, connecting the call to a first  
17 base station controller; detecting whether the terminal has been authenticated, said detecting  
18 being performed through a private authentication system; and when the terminal has been  
19 authenticated, establishing a connection to the requested destination address to perform  
20 communication.

1     **[0019]**   In accordance with the principles of the present invention, as embodied and broadly  
2     described, the present invention provides a call in method of a high-speed wireless data system,  
3     the call in method comprising: when a call connection is required to a predetermined terminal  
4     from a predetermined packet data service node, transmitting a first paging request to a location  
5     register from a first base station controller, the system including a hub and at least the first base  
6     station controller; the hub distinguishing public wireless network services and private wireless  
7     network services in performing routing; transmitting a first paging response from the location  
8     register to the first base station controller in response to the first paging request; providing a  
9     paging signal to a second base station controller, the second base station controller controlling  
10    a base station where the terminal is located, the second base station controller being selected  
11    from among the first base station controller and a plurality of additional base station controllers;  
12    paging the terminal from the second base station controller in response to the paging signal;  
13    when a paging answer signal is received from the terminal in response to said paging,  
14    authenticating the terminal through an authentication system; and performing communication  
15    between the terminal and the packet data service node when said authenticating is completed.

16   **[0020]**   The present invention is more specifically described in the following paragraphs by  
17   reference to the drawings attached only by way of example. Other advantages and features will  
18   become apparent from the following description and from the claims.



**BRIEF DESCRIPTION OF THE DRAWINGS**

**[0021]** A more complete appreciation of the invention, and many of the attendant advantages thereof, will be readily apparent as the same becomes better understood by reference to the following detailed description when considered in conjunction with the accompanying drawings in which like reference symbols indicate the same or similar components, wherein:

**[0022]** FIG. 1 is a block diagram showing a network configuration of a high-speed wireless data system for using either a public network or a private network, in accordance with the principles of the present invention;

**[0023]** FIG. 2 is a block diagram of an IP-based base station controller which can use both public network services and private network services, in accordance with the principles of the present invention;

**[0024]** FIG. 3 shows signaling flows when a call out is required at a terminal of a private network, in accordance with the principles of the present invention; and

**[0025]** FIG. 4 shows signaling flows when a call in is required to a terminal of a private network from a private packet data service node, in accordance with the principles of the present invention.

**DETAILED DESCRIPTION OF THE INVENTION**

**[0026]** While the present invention will be described more fully hereinafter with reference to the accompanying drawings, in which details of the present invention are shown, it is to be understood at the outset of the description which follows that persons of skill in the appropriate

1 arts may modify the invention here described while still achieving the favorable results of this  
2 invention. Accordingly, the description of the best mode contemplated of carrying out the  
3 invention, which follows, is to be understood as being a broad, teaching disclosure directed to  
4 persons of skill in the appropriate arts, and not as limiting upon the present invention.

5 **[0027]** Illustrative embodiments of the best mode of carrying out the invention are described  
6 below. In the interest of clarity, not all features of an actual implementation are described. In  
7 the following description, well-known functions, constructions, and configurations are not  
8 described in detail since they could obscure the invention with unnecessary detail. It will be  
9 appreciated that in the development of any actual embodiment numerous implementation-  
10 specific decisions must be made to achieve the developers' specific goals, such as compliance  
11 with system-related and business-related constraints, which will vary from one implementation  
12 to another. Moreover, it will be appreciated that such a development effort might be complex  
13 and time-consuming, but would nevertheless be a routine undertaking for those of ordinary skill  
14 having the benefit of this disclosure.

15 **[0028]** Mobile communication systems have been further developed in order to provide a user  
16 with the ability to make voice phone calls while on the move, using mobile telephones. Due to  
17 technical developments in an attempt to meet the demands of users, mobile communication  
18 systems mainly for voice calls can now provide short data services. That is, mobile  
19 communication systems provide not only voice call services, but also additional services, such

1 as short message transmission, music file transmission for bell sounds of wireless terminals,  
2 simple Internet communications, banking services, and other services. Studies have been  
3 performed to try to develop mobile communication systems which can provide mobile  
4 communication subscribers with not only the services mentioned above but also more  
5 information at higher speed. Also, preparations to commercialize such systems may now be in  
6 progress. As a system for implementing high-speed data services with a mobile communication  
7 terminal, a system termed CDMA200 1x EV-DO (hereinafter referred to as “high-speed wireless  
8 data system”) has been proposed. “CDMA” is code division multiple access. The high-speed  
9 wireless data system has channels, such as a data channel for transmitting data at high speed, an  
10 augmentation channel, a signaling channel and a medium access control (MAC) channel, which  
11 are different from the channels of earlier systems. Accordingly, studies have been made  
12 regarding the standards for these channels and various data which can be carried by these  
13 channels. As stated above, the properties of the high-speed wireless data system are different  
14 from those of earlier wireless networks.

15 **[0029]** Wireless networks are divided into public wireless networks and private wireless  
16 networks. Generally, each of the private wireless networks, which is used by a group or a  
17 company for a particular purpose, is configured to interwork with a particular public wireless  
18 network. More specifically, each private wireless network should comprise a base station  
19 (ANTS) and a base station controller (ANC) which are necessary in a public wireless network,  
20 as well as a private switching system. For authentication, each private wireless network should

1 be equipped with a visitor location register (VLR) or home location register (HLR). A private  
2 wireless network constructed with all of these components however, is simply too expensive.  
3 Furthermore, a terminal used in a private wireless network needs also be used in a public  
4 wireless network.

5 **[0030]** It would not be convenient and it would not be cost effective for a user to use two  
6 different terminals to move from a private wireless network to the outside and vice versa. If a  
7 private wireless network and a public wireless network are built for different purposes in the  
8 same area, there will be a requirement to build more than one base station in the same area or  
9 neighboring areas, thereby causing the base station builders a loss of their cost.

10 **[0031]** Therefore, a method is provided for using part of a public wireless network as a private  
11 wireless network. According to this method, a mobile terminal can be provided with private  
12 wireless network services within a certain area and with public wireless network services in  
13 other areas. This method is economically advantageous because only one base station is needed  
14 in the same area. Thus, technologies for providing different services in a certain area and in  
15 other areas have been developed.

16 **[0032]** As described above however, a high-speed wireless data system is different in many  
17 aspects from current CDMA 1x systems mainly providing voice services. It is believed to be  
18 impossible to share a public wireless network and a private wireless network with currently

1 available CDMA 1x systems, in terms of systems that can actually be produced and utilized at  
2 a reasonable price. That is, it is believed that current systems cannot be used to share a public  
3 wireless network and a private wireless network at a reasonable price.

4 **[0033]** Furthermore, base stations and base station controllers for currently available 1x  
5 EV-DO systems use very expensive equipment, because they use asynchronous transfer mode  
6 (ATM) switches. Therefore, there is a requirement to provide low-priced base stations and base  
7 station controllers.

8 **[0034]** Thus, there appears to be a need for a new, improved, convenient, and efficient method  
9 and system enabling users to access public wireless networks and private wireless networks in  
10 a 1x EV-DO system, to receive information at a high-speed rate, for video conference calls, to  
11 watch movies received from one of the wireless networks, and for other reasons. Also, there is  
12 a requirement to provide low-priced base stations and base station controllers while providing  
13 the new, improved method and system in a 1x EV-DO system.

14 **[0035]** Exemplars of efforts related to networking and communications include: U.S. Patent  
15 No. 6,374,102 to Brachman *et al.*, entitled *USER PROACTIVE CALL HANDLING*, issued on  
16 April 16, 2002, U.S. Patent Application Publication No. 2002/0167905 to Wenzel *et al.*, entitled  
17 *IDENTIFICATION OF UNUSED RESOURCES IN A PACKET DATA NETWORK*, published on  
18 November 14, 2002, U.S. Patent No. 5,845,211 to Roach Jr., entitled *WIRELESS DIGITAL*

1 *NETWORK*, issued on December 1, 1998, U.S. Patent Application Publication No.  
2 2002/0091933 to Quick Jr *et al.*, entitled *LOCAL AUTHENTICATION IN A COMMUNICATION*  
3 *SYSTEM*, published on July 11, 2002, U.S. Patent Application Publication No. 2002/0067707  
4 to Morales *et al.*, entitled *METHOD AND APPARATUS TO CONTROL HANDOFF BETWEEN*  
5 *DIFFERENT WIRELESS SYSTEMS*, published on June 6, 2002, and U.S. Patent Application  
6 Publication No. 2002/0191595 to Mar *et al.*, entitled *PROVIDING COMMUNICATIONS*  
7 *CAPABILITIES TO MOBILE DEVICES AT AN ENTERPRISE*, published on December 19, 2002.

8 The foregoing efforts are not without merit, but further improvements can be contemplated.

9 **[0036]** Hereinafter, a preferred embodiment of the present invention will be described with  
10 reference to the accompanying drawings. In the drawings, the same element, although depicted  
11 in different drawings, will be designated by the same reference numeral or character.

12 **[0037]** In the following description of the present invention, items such as specific server  
13 addresses and specific messages are used merely to improve understanding of the present  
14 invention. It will be apparent to those skilled in the art that the present invention is not to be  
15 limited to such specific examples. Also, in the following description of the present invention,  
16 a detailed description of known functions and configurations incorporated herein will be omitted  
17 when it may make the subject matter of the present invention rather unclear.

18 **[0038]** FIG. 1 is a block diagram showing a network configuration of a high-speed wireless

data system for using either a public network or a private network, in accordance with the principles of the present invention. FIG. 1 is a block diagram showing a network configuration of a high-speed wireless data system according to one embodiment of the present invention, for using either a public network or a private network. The network configuration, function, and operation of the high-speed wireless data system according to the present invention will be described in detail with reference to FIG. 1. It should be noted that an access network transfer system (*i.e.*, an “ANTS”) has a function block that is similar to a BTS in an 1x EV-DO system. In FIG. 1, nodes which are used in a private wireless network only or in both a private wireless network and a public wireless network are represented by lower case letter “p” as a prefix before the corresponding reference symbol or label.

**[0039]** The high-speed wireless data terminals 11 and 21 as shown in FIG. 1 are terminals which are used in general high-speed wireless data systems. The terminals 11 and 21 can be referred to as access nodes (AN) or access terminals (AT). It is assumed that one terminal 11 is a subscriber receiving both private and public wireless network services and the other terminal 21 is a subscriber receiving public wireless network services. The base stations pANTS, a private access network transfer system 101, and pANTS 102 shown in FIG. 1 have predetermined wireless service areas 10 and 20, respectively. When a terminal enters a wireless service area, each of the base stations 101 and 102 sets a session and performs an operation necessary to assign an Unicast Access Terminal Identifier, an Unicast Access Terminal Identifier (*i.e.*, an “UATI”) required for the terminal. The an Unicast Access Terminal Identifier is a



1 unicast access terminal identifier (UATI). The PANTS performs a function similar to a BTS in  
2 a general mobile communication system, but does not assign an Unicast Access Terminal  
3 Identifier (*i.e.*, the “UATI”) to a terminal. Typically, only a data location register (*i.e.*, the  
4 “DLR”) assigns the UATI to a terminal, and then transmits the assigned UATI to a base station  
5 where a mobile terminal is located. At this time, the base station usually performs only an  
6 operation for transferring the UATI to the mobile terminal on a radio line. When a call is  
7 terminated at or originated from a terminal, each of the base stations performs a necessary  
8 operation accordingly. The base stations 101 and 102 are connected to a hub 110.

9 [0040] The hub 110 is connected to other nodes in the private wireless network and to each  
10 node in the public wireless network or another hub connected to other nodes in the public  
11 wireless network. FIG. 1 shows that the hub 110 is connected to another hub 120 which enables  
12 the hub 110 to be connected to the outside of the private wireless network. The hub 110  
13 connected to each node of the private wireless network discriminates between services for a  
14 terminal or private packet data service node (pPDSN) 111 in the private wireless network and  
15 services for the outside of the private wireless network when it performs routing in response to  
16 a call from a terminal within the private wireless network. In other words, a call to the inside  
17 of the private wireless network is connected to a private base station controller (pANC) 112  
18 within the private network, while a call to the public wireless network is connected to the hub  
19 120. An access network controller (*i.e.*, an “ANC”) has a function block that is similar to a BSC  
20 in an 1x EV-DO system. The hub 110 has predetermined server addresses utilized in



1 determining whether a call is originated to the inside of the private wireless network or not.

2 When there is a call to a server or an Unicast Access Terminal Identifier terminal having the  
3 server, which has an Unicast Access Terminal Identifier information containing a server address  
4 belonging to the predetermined server addresses in the hub 110, the call is detected as a call to  
5 the inside of the private wireless network.

6 **[0041]** For example, a an Unicast Access Terminal Identifier is assigned by a data location  
7 register (DLR) 121 to a private wireless network subscriber to have a predetermined server  
8 address. If predetermined server addresses are "samsung.co.kr," "samsung.com," etc., a terminal  
9 of the private wireless network may have an address such as "111@samsung.co.kr." If the  
10 terminal of the private wireless network requests to access one of the predetermined server  
11 addresses or originates a call to a terminal having one of the predetermined server addresses,  
12 such as the address "aaa@samsung.com," for example, the call from the terminal is detected as  
13 a call to the inside of the private wireless network. When none of the predetermined server  
14 addresses are contained in the Unicast Access Terminal Identifiers of the terminal originating  
15 the call and of the terminal or server at which the call is requested to be terminated, the call is  
16 detected as a call to the public wireless network. In contrast, a call from a server may be  
17 determined as a call to the private wireless network even when an Unicast Access Terminal  
18 Identifier of only the server has a predetermined server address.

19 **[0042]** To perform intermediation of data, the hub 110 is connected to the private packet data

1 serving node (pPDSN) 111 used by only the terminals of the private wireless network, the base  
2 station controller (pANC) 112 used in either the public wireless network or the private wireless  
3 network, and a private access network authentication accounting authorization (pAN-AAA)  
4 system 113 used in only the private wireless network. The pAN-AAA system 113 may be used  
5 in either the public wireless network or the private wireless network without a special limitation,  
6 but the description below is given under the presumption that it should be used only in the  
7 private wireless network for convenience of description. The pAN-AAA 113 can be said to  
8 either store an authentication database or to access a stored authentication database. The  
9 authentication database is for authenticating at least the private wireless network terminal.

10 **[0043]** The base station controller (pANC) 112 controls assignment of session and setting of  
11 unicast access terminal identifier (UATI) for a terminal and authentication of the terminal by  
12 means of the system 113. More detailed description about this control operation will be given  
13 below.

14 **[0044]** To intermediate data between nodes, the hub 120 is connected to a general access  
15 network authentication accounting authorization (*i.e.*, "AN-AAA") 122, a base station controller  
16 (ANC) 123, a packet data serving node (PDSN) 124, and a data location register (DLR) 121  
17 storing information of terminals. Further, the hub 120 may be connected to a base station of the  
18 public wireless network, although not shown in FIG. 1.

1     **[0045]** The packet data serving node (PDSN) 124 may be connected to other packet or serving  
2     nodes through the Internet or the private packet data serving node (pPDSN) 111. Further, the  
3     base station controller (ANC) 123 is a general base station controller of the high-speed wireless  
4     data system, and the authentication system (AN-AAA) 122 also is a general authentication  
5     system of the high-speed wireless data system, where authentication determines whether a  
6     particular subscriber belongs to the private network or belongs to the public network.

7     **[0046]** The data location register (DLR) 121 stores information about terminals of the  
8     high-speed wireless data system and their location information, and provides information about  
9     a terminal when session for the terminal is updated. Embodiments of the present invention  
10    provide a method that allows a mobile terminal for an 1x EV-DO system to be used in both a  
11    private wireless network and a public wireless network. Accordingly, a data location register  
12    has to store not only information to be provided from the private wireless network to the  
13    terminal, but also information to be provided from the public wireless network to the terminal.  
14    Specifically, the terminals in the present invention can be divided into three. First is a terminal  
15    to be used in a public network; another is a terminal to be used in a private network; and the third  
16    is a terminal to be used both the public and the private network. Accordingly, as above, there  
17    are three types of terminals in the present invention, and in case of the third terminal, the DLR  
18    has to include both information to be used in the private network and information to be used in  
19    the public network. Data location register (DLR) 121 also stores general information  
20    corresponding to, or pertaining to, terminals in the public wireless network. The general

1 information about each terminal in the public wireless network includes terminal information,  
2 user information, and information of service grade. The data location register (DLR) 121 stores  
3 information for receiving services from the private wireless network to a private wireless  
4 network terminal. The data location register (DLR) 121 stores information for providing or  
5 transmitting services of the private wireless network to a private wireless network terminal.

6 **[0047]** The data location register (DLR) 121 may further store information about terminals in  
7 the private wireless network according to the present invention. In this case, the information  
8 stored in the data location register (DLR) 121 may be classified into first information when the  
9 terminal operates only in the private wireless network and second information when the terminal  
10 operates in either the private wireless network or the public wireless network. The description  
11 below will be given under the presumption that the terminal operates in either the private  
12 wireless network or the public wireless network. In this case, the data location register (DLR)  
13 121 stores not only the same information for the private wireless network as the information  
14 required for the public wireless network, but also inherent information about the private wireless  
15 network. The inherent information of the private wireless network should include service time,  
16 types of services, and service area such as servicing base station or sector, etc. Moreover, the  
17 data location register (DLR) 121 may assign an Unicast Access Terminal Identifier to each  
18 terminal with a special engagement, where that “special engagement” is arbitrarily set according  
19 to a service that is to be provided by another business, such as a service provider. The special  
20 engagement can require that a private wireless network terminal be near a predetermined base

1 station in a predetermined time zone, for example.

2 **[0048]** When a terminal of the private wireless network operates, an identifier which enables  
3 discrimination between connections to the private wireless network and the public wireless  
4 network may be further transmitted, as described in detail below with reference to signal flow  
5 diagrams.

6 **[0049]** The base stations 101 and 102, the base station controllers pANC 112 and ANC 123,  
7 the data location register (DLR) 121, and the packet data serving nodes pPDSN 111 and PDSN  
8 124 may be constructed on the basis of Internet protocol (IP) to reduce the price of the system,  
9 because asynchronous transfer mode (ATM) -based connections usually employed between the  
10 base stations and the base station controllers can increase the price of the system. When the base  
11 stations 101 and 102, the base station controllers 112 and ANC 123, the data location register  
12 (DLR) 121, and the packet data serving nodes pPDSN 111 and PDSN 124 are constructed on the  
13 basis of Internet protocol (IP) as described above, interprocessor communication (IPC) can be  
14 carried out between internal boards or processors. Further, an Internet protocol (IP) address is  
15 assigned to an internal processor or board of each node. Further, an internal Internet protocol  
16 (IP) address may be assigned to each node located within a station house such as a house of a  
17 central office or a control station while a fixed Internet protocol (IP) address is assigned to each  
18 node located far from the station house, so as to prevent lack of Internet protocol (IP) address.

1     **[0050]**   Interfacing between the base stations 101 and 102 and base station controllers 112 and  
2     ANC 123 can be carried out by means of asymmetric digital subscriber line (ADSL) modems or  
3     cable modems. The authentication systems pAN-AAA 113 and AN-AAA 122 and the packet  
4     data serving nodes pPDSN 111 and PDSN 124 do not need to be subjected to any modification,  
5     since they are originally constructed to employ the Internet protocol (IP)-basis.

6     **[0051]**   FIG. 2 is a block diagram of an Internet protocol (IP)-based base station controller  
7     which can use both public network services and private network services, in accordance with the  
8     principles of the present invention. The base station controller is capable of using either the  
9     public network or the private network on the basis of Internet protocol (IP) according to the  
10    present invention. Hereinafter, the construction and operation of the base station controller  
11    according to the present invention will be described in detail with reference to FIG. 2. The  
12    description below is based on a presumption that the base station controller depicted in FIG. 2  
13    is the base station controller 112 of the private wireless network shown in FIG. 1.

14   **[0052]**   A control unit 211 controls general operation of the base station controller 112. For  
15    example, the control unit 211 sets and updates sessions for authentication of terminals and  
16    performs control for assignment of Unicast Access Terminal Identifiers, traffic control according  
17    to call setting, and various signaling control. A signal processor 212 performs various signaling  
18    processes required in the base station controller 112. For example, the signal processor 212  
19    delivers a paging signal to a terminal or controls operations in relation to assignment of an

1 Unicast Access Terminal Identifier, storage of location information, and assignment and  
2 updating of session information to the data location register (DLR) 121. A protocol processor  
3 213 processes protocols required in communication between the terminal 11 and the public  
4 packet data serving node (PDSN) 124 or private packet data serving node (pPDSN) 111,  
5 according to the control by the control unit 211.

6 **[0053]** A traffic processor 214 processes traffic transferred from the packet data serving nodes  
7 pPDSN 111 and PDSN 124 to the terminal 11, from the terminal 11 to the packet data serving  
8 nodes pPDSN 111 and PDSN 124, or from the terminal 11 to the other terminal 21, according  
9 to the control by the control unit 211. A memory 215 stores program data for the general  
10 operation of the base station controller 112, Unicast Access Terminal Identifiers and session  
11 information of terminals located within the area of the base station controller 112, and control  
12 data and traffic data to be temporarily stored during communication. The base station controller  
13 112 includes multiple sheets of boards.

14 **[0054]** When the control unit 211, the signal processor 212, the protocol processor 213, and  
15 the traffic processor 214, etc., have different boards from each other, each board may be  
16 provided with an Internet protocol (IP) for internal processing, so as to perform Internet protocol  
17 (IP) communication. Further, when the base station controller 112 is located far from a station  
18 house, a fixed Internet protocol (IP) may be assigned to the base station controller 112 for data  
19 transmission. The construction of the base station controller 112 as described above can be



1 employed in the base station 101 in the same manner.

2 **[0055]** Internet protocol (IP) communication interface 217 performs interfacing of signals or  
3 traffic data transmitted or received in Internet protocol (IP) communication between the base  
4 station controller 112 and other devices. That is, the signals and data received with the Internet  
5 protocol (IP) communication protocol are converted into internally-processible types, which are  
6 then transferred to the control unit 211 and corresponding processors 212, 213, and 214 through  
7 an interprocessor communication (*i.e.*, “IPC”) line 216. Internet protocol (IP) communication  
8 interface 217 stores data in the memory 215 when buffering is necessary.

9 **[0056]** Although the above description is given about the base station controller 112, it can  
10 be equally applied to either the base stations 101 and 102 or the base station controller ANC 123  
11 of the public wireless network instead of the private wireless network. Further, although the hub  
12 110 performs judgment whether the terminal belongs to the private wireless network or the  
13 public wireless network in the description of FIG. 1, the base station controller 112 may perform  
14 the judgment instead. In the latter case, the judgment may be carried out by the control unit 211  
15 or a separate board arranged for the judgment. That is, the present invention pays attention only  
16 to performance of the judgment whether the terminal belongs to the private wireless network or  
17 the public wireless network, but no attention to the means for performing the judgment.  
18 However, it is most preferred that the hub 110 or the base station controller 112 performs the  
19 judgment, as is in the embodiments described above.



1     **[0057]**     FIG. 3 shows signaling flows when a call out is required at a terminal of a private  
2     network, in accordance with the principles of the present invention. FIG. 3 is a signal flow  
3     diagram when a terminal of the private wireless network requests origination of a call according  
4     to the present invention. Hereinafter, flow of signals and operations of systems when a terminal  
5     of the private wireless network requests origination of a call will be described in detail with  
6     reference to FIGs. 1 to 3.

7     **[0058]**     At step S300, when a terminal 11 requests origination of a call through 1x EV-DO  
8     system, the terminal 11 transmits to the base station 101 an access request signal together with  
9     unicast access terminal identifier (UATI) and an address of destination according to a protocol  
10    defined in an air (wireless) interface. At step S302, when the base station 101 receives the  
11    access request signal, the base station 101 performs Internet protocol (IP) communication  
12    process and transfers the access request signal to the hub 110. At step S304, the hub 110 judges  
13    whether the received access request signal is requesting to connect with the private wireless  
14    network or the public wireless network. As described above with reference to FIG. 1, this  
15    judgment is carried out by comparing the server address of the terminal 11 with addresses stored  
16    in advance. Here, the description below is given under the presumption that access to the private  
17    wireless network is requested.

18    **[0059]**     At step S306, as a result of the judgment in step S304, when access to the private  
19    wireless network is requested, the hub 110 transfers the access request signal to the base station

1 controller 112 used for either the private wireless network or the public wireless network  
2 according to the Internet protocol (IP) communication protocol. The base station controller 112  
3 receives the access request signal through the Internet protocol (IP) communication interface  
4 217. Then, the Internet protocol (IP) communication interface 217 of the base station controller  
5 112 transmits the access request signal to the signal processor 212. The signal processor 212  
6 informs the control unit 211 that access has been requested. Then, the control unit 211 controls  
7 the signal processor 212 to transfer an authentication request signal to the private authentication  
8 system 113. The authentication request signal is transferred to the private authentication system  
9 113 through the Internet protocol (IP) communication interface 217. In other words, at step  
10 S308, the authentication request signal is transferred from the base station controller 112 to the  
11 private authentication system 113.

12 [0060] When the private authentication system 113 receives the authentication request signal,  
13 the private authentication system 113 examines unicast access terminal identifier (UATI) of the  
14 terminal to determine whether the terminal has been authenticated or not. At step S310, the  
15 private authentication system 113 transfers the result of the authentication to the base station  
16 controller 112. An authentication confirmation signal, which is the result of the authentication,  
17 may imply either success or failure of the authentication. When it is confirmed that the terminal  
18 has been authenticated, the process as shown in FIG. 3 progresses. When the authentication  
19 meets with failure however, an authentication failure signal is generated and transferred to the  
20 terminal 11. The failure of the authentication is processed in the same manner as that in a

1 general 1x EV-DO system.

2 **[0061]** In the base station controller 112, the authentication confirmation signal is received  
3 through the Internet protocol (IP) communication interface 217, transferred through the  
4 interprocessor communication (IPC) line 216, and processed by the signal processor 212 and the  
5 control unit 211. At step S312, when it is confirmed that the terminal has been authenticated,  
6 the base station 101 controls the signal processor 212 to send an access confirmation signal to  
7 the hub 110 and the base station 101.

8 **[0062]** At step S314, when the base station 101 has received the access confirmation signal  
9 through the above-described process, the base station 101 transfers the access confirmation  
10 signal through the air interface to the terminal 11. Then, at step S316, the terminal 11 having  
11 received the access confirmation signal communicates with a targeted packet data serving node  
12 pPDSN 111. In the above description, the terminal requests origination of a call to the private  
13 wireless network and thus communicates with the private packet data serving node pPDSN 111.  
14 When origination of a call to the packet data serving node PDSN 124 of the public wireless  
15 network is requested also, however, the signal is processed in the same manner as above  
16 excepting that the signal further passes through the hub 120 and the base station controller AN-  
17 AAA 122 of the public wireless network.

18 **[0063]** The transmission and reception of data are performed by the traffic processor 214 of

1 the base station controller 112. Furthermore, the protocols of the transmitted and received data  
2 are processed by the protocol processor 213. Meanwhile, FIG. 3 does not show a process of the  
3 base station controller 112 processing the signal to the packet data serving node pPDSN 111,  
4 which is the same as a general process performed in the 1x EV-DO system, but illustrates that  
5 the access confirmation signal is transmitted to the terminal directly after the authentication and  
6 then communication is performed.

7 **[0064]** When the communication has been completed, the location of the mobile terminal can  
8 be registered through the same process as the location registration process performed in a general  
9 1x EV-DO system.

10 **[0065]** FIG. 4 shows signaling flows when a call in is required to a terminal of a private  
11 network from a private packet data service node, in accordance with the principles of the present  
12 invention. FIG. 4 is a signal flow diagram when the private packet data serving node requests  
13 a call to be terminated at a terminal of the private wireless network according to the present  
14 invention. Hereinafter, flow of signals and operations of systems when the private packet data  
15 serving node requests a call to be terminated at a terminal of the private wireless network will  
16 be described in detail with reference to FIGs. 1, 2, and 4.

17 **[0066]** At step S400, when the private packet data serving node pPDSN 111 requests a call  
18 to be terminated at the terminal 11 of the private wireless network, the private packet data

1 serving node pPDSN 111 transmits an access request signal to the predetermined base station  
2 controller 112. In this case, the predetermined base station controller 112 is a base station  
3 controller for controlling an operation of only the private wireless network or operations of  
4 either the private wireless network or the public wireless network. The access request signal is  
5 transferred through the hub 110, although not separately shown in FIG. 4.

6 **[0067]** When the access request signal is received, the Internet protocol (IP) communication  
7 interface 217 of the base station controller 112 transfers the access request signal to the signal  
8 processor 212 as described above in detail with reference to FIG. 3, and data processed in the  
9 signal processor 212 are transferred to the control unit 211. Then, the control unit 211 controls  
10 generation of a paging request signal to the data location register (DLR) 121. At step S402, the  
11 paging request signal is generated in the signal processor 212 and is transferred to the data  
12 location register (DLR) 121. At step S404, when the data location register (DLR) 121 receives  
13 the paging request signal, the data location register (DLR) 121 searches location information of  
14 the terminal and transfers the searched result to the base station controller 112.

15 **[0068]** When the base station controller 112 receives a paging response signal, which is the  
16 searched result, and the terminal is located within an area of a base station controlled by the base  
17 station controller 112, the base station controller 112 transmits the paging request signal to the  
18 corresponding base station. However, when the terminal is not located within the area of the  
19 base station controlled by the base station controller 112, the base station controller 112

1 transmits the paging request signal to the corresponding base station controller controlling a base  
2 station having an area in which the terminal is located. As an alternative method, the base  
3 station controller 112 may be connected to the corresponding base station controller by means  
4 of the packet data serving node pPDSN 111. The description below will be based on the  
5 presumption that the terminal at which the call is terminated is a terminal belonging to the  
6 private wireless network and is located within the area of the base station 101 of the private  
7 wireless network.

8 **[0069]** At step S406, when the terminal 11 is located within the area of the base station  
9 controller 112 as described above, the base station controller 112 transmits the paging request  
10 signal to the corresponding base station 101 through the hub 110. At step S408, when the base  
11 station 101 receives the paging request signal, the base station 101 performs a paging operation,  
12 which is an operation of reporting call-termination to the corresponding terminal as defined in  
13 the air interface. At step S408, it can be said that a paging signal is transmitted from base station  
14 101 to terminal 11, or it can be said that the base station 101 pages terminal 11.

15 **[0070]** At step S410, when a user of the terminal 11 responds, the terminal 11 transmits a  
16 paging response signal or paging answer signal to the base station 101, as defined in the air  
17 interface. Then, at step S412, the base station 101 transfers the paging response signal to the  
18 base station controller 112 through the hub 110. At step S414, the base station controller 112  
19 generates and sends an authentication request signal to the private authentication system 113

1 when it has received the paging response signal. In this case also, the authentication request  
2 signal is transmitted through the Internet protocol (IP) communication.

3 **[0071]** Then, at step S416, the private authentication system 113 examines whether the  
4 terminal has been authenticated or not, and generates and sends an authentication confirmation  
5 signal to the base station controller 112. The authentication confirmation signal may imply  
6 either success or failure of the authentication. At step S418, when it is confirmed that the  
7 terminal has been authenticated, the process as shown in FIG. 4 is progressed, that is,  
8 communication is made between the terminal 11 and the private packet data serving node  
9 pPDSN 111. However, when the authentication meets with failure, an authentication failure  
10 signal is generated and transferred to the terminal 11 and the private packet data serving node  
11 pPDSN 111. The failure of the authentication is processed in the same manner as that in a  
12 general 1x EV-DO system.

13 **[0072]** When the communication has been completed, the location of the mobile terminal can  
14 be registered through the same process as the location registration process performed in a general  
15 1x EV-DO system.

16 **[0073]** When a high-speed wireless data system has the construction described above  
17 according to the present invention, a user of the system can use either a public network or a  
18 private network, or both networks, and can reduce overlapping or redundant and inefficient

1 investment. Further, the base station and the base station controller of the high-speed wireless  
2 data system employing the Internet protocol (IP) communication mode according to the present  
3 invention can reduce the price of the high-speed wireless data system.

4 **[0074]** While the present invention has been illustrated by the description of embodiments  
5 thereof, and while the embodiments have been described in considerable detail, it is not the  
6 intention of the applicant to restrict or in any way limit the scope of the appended claims to such  
7 detail. Additional advantages and modifications will readily appear to those skilled in the art.  
8 Therefore, the invention in its broader aspects is not limited to the specific details, representative  
9 apparatus and method, and illustrative examples shown and described. Accordingly, departures  
10 may be made from such details without departing from the spirit or scope of the applicant's  
11 general inventive concept.